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(12) PATENT SPECIFICATION A5

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(54) Artificial Lens for a Human Eye

(57) The artificial lens (1) provided for implantation into the natural phacocyst has an elastically deformable lens body (2) enveloped by an also elastically deformable force transmission section (3), and designed as a single piece with the latter. The force transmission section (3) has a bead-like edge area (4), which is connected with the lens body (2) via a connecting section (5). When implanted, the bead-like edge area (4) of the artificial lens (1) engages the phacocyst in the area of its zonula lamella. Dimensional changes in the phacocyst during accommodation are hence conveyed to the lens body (2) via the edge area (4) and connecting section (5), thereby changing the refractive power of the lens body (2).

Specification

This invention relates to an artificial lens for implantation into a human eye.

The object of this invention is to provide an artificial lens of the aforementioned type that permits a certain adjustment during near and far viewing, similar to a natural lens.

This object is achieved according to the invention by the features in Claim 1.

An exemplary embodiment of the subject matter of the invention will be described in greater detail based on the drawing. Diagrammatically shown on:

Fig. 1 is a sectional view of the artificial lens in cross section;

Fig. 2 is a top view of the back side of the artificial lens, and

Fig. 3 is a sectional view of a human eye with inserted artificial lens according to Fig. 1 and 2.

The elastically deformable artificial lens 1 shown on the figures has an elastically deformable lens body 2, which is enveloped by a force transmission section 3 that forms a single piece with the latter, and is also elastically deformable. The lens body 2 is roughly cylindrical in this embodiment, and has a forwardly bent, convex front surface 2a. The force transmission section 3 is curved in the backward direction, yielding a plate-like design of the artificial lens 1. The force transmission section 3 has a bead-like edge area 4, which is connected with the lens body 2 via a connecting section 5.

The shape, size and optical properties of the lens body 2 are tailored to the shape, size and optical properties of the natural lens to be replaced in the non-accommodated state.

Two opposing, flat notches 7, 8 can be provided in the edge area to facilitate insertion of the artificial lens 1. Through holes 9 can be provided in the connecting section 5 for the same purpose.

In addition to elastic deformability, the following requirements are placed on the material to be used as the artificial lens: biocompatible, chemically inert, no material changes during contact with tissue, good tolerance without irritation or reaction to foreign

bodies, no carcinogenic or allergic effect, good resistance to mechanical stress while being rolled or folded during implantation.

Materials that exhibit the aforementioned properties include hydrogels and silicones.

The described artificial lens 1 is inserted in the natural phacocyst after the natural lens has been surgically removed, e.g., given a gray cataract, in which case the zonula apparatus and phacocyst are preserved on its front side except for a window. The inserted artificial lens 1 is now intended to fill and relax the phacocyst similarly to the healthy natural lens, so that the zonula fibers have a tonicity resembling the natural tonicity with the ciliary muscle at rest, and the forces acting on the elastically deformable artificial lens, which are triggered by changes in the shape of the phacocyst during accommodation, result in corresponding dimensional changes in the lens body 2. This will now be illustrated based in Fig. 3.

In Fig. 3, the individual parts of the human eye are denoted as follows: cornea 10, sclera 11, iris 12, ciliary body 13, zonula fibers 14, and phacocyst 15. The front side of the phacocyst 15 has a window 16 with a diameter of about 4.5 mm, through which the artificial lens 1 is inserted into the phacocyst 15.

The zonula fibers 14 engage the zonula lamella 17, which are comprised of two thickened zones front and back on the phacocyst 15 near the equator 18. The artificial lens 1 inserted into the phacocyst 15 now rests against the phacocyst 15 with the edge area 4 of the force transmission section 3 in the area of this zonula lamella 17. The shape of the artificial lens 1 illustrated in Fig. 1 and 2 along with its elastic deformability causes the artificial lens 1 to relax the phacocyst 15, as already mentioned, so that its rear wall 15a is approximately flat. This yields a cavity 19 between this rear wall 15a and the lens body 16, which makes it possible to also burn out a window in this rear wall 15a when required without damaging the artificial lens 1.

Because the edge area 4 of the artificial lens 1 engages the phacocyst 15 in the area of the zonula lamella 17 as described, changes in the shape of the phacocyst 15 that arise during accommodation are transferred to the lens body 2, which then correspondingly undergoes a dimensional change, and hence a modification of its optical properties, i.e., refractive power. This process can be easily traced based in Fig. 3, in

which the right half represents the non-accommodated state, and the left half represents the accommodated state.

In the non-accommodated state, the ciliary muscle of the ciliary body 13 is relaxed. The zonula fibers 14 are tensed, as a result of which the plate-like artificial lens 1 flattens. This produces a sharp image of the objects located a greater distance away.

In the accommodated state (left half of Fig. 3), the ciliary muscle is contracted, and the zonula fibers 14 are relaxed. The phacocyst 15 contracts along the equator 18, resulting in a corresponding reduction in diameter of the phacocyst 15. This means that the artificial lens 1 is also compressed, causing a thickening, i.e., more intensive curving, of the lens body 2. This produces a sharper image of the nearby objects.

Claims

1. An artificial lens for use in the phacocyst (15) of a human eye, with an elastically deformable lens body (2) enveloped by an also elastically deformable force transmission section (3), the bead-like edge area (4) of which is designed to engage the phacocyst (15) in the area of its zonula lamella (17), and which conveys the changes in the shape of the phacocyst (15) that arise during accommodation to the lens body (2), thereby correspondingly changing its shape, and hence refractive power.

2. Artificial lens according to Claim 1, characterized in that the lens body (2) and force transmission section (3) are designed as a single piece.

3. Artificial lens according to Claim 1, characterized in that it has a plate-like design, and exhibits a backwardly curved force transmission section (3).

4. Artificial lens according to one of Claims 1-3, characterized in that the optical properties of the lens body (2) are adjusted to those of the natural lens to be replaced in the non-accommodated state.

5. Artificial lens according to one of Claims 1-4, characterized in that two opposing notches (7 and 8) are present in the edge area (4) of the force transmission section (3).

6. Artificial lens according to one of Claims 1-5, characterized in that through holes (9) are provided in the force transmission section (3) between its edge area (4) and the lens body (2).

7. Artificial lens according to one of Claims 1-6, characterized in that it consists of a biocompatible material, e.g., hydrogel or silicone.